

Midscale Summary



Jeremy Darling
(U Colorado)

Midscale Summary



What follows will be incomplete (Swann's Way, at best) and highly biased (involuntary memory).

Midscale Summary



Rather than follow the chronology of the talks (*Remembrance of Things Past*), let's order projects by their inertial masses (ponderousness)...virtual objects last.

2020 Decadal Survey

- **If Astro 2020 follows the 2010 survey timeline, the survey will begin activities in fall 2018.**
- **We have only *two years* to organize and prioritize...**

...and think about exciting new science.

Midscale Summary

Uniqueness

Complementarity/Context

Risk/Readiness

Reward

Cost

Discovery Potential

Equipping ALMA For the Next Decade and Beyond

(Crystal Brogan)



Equipping ALMA For the Next Decade and Beyond

(Crystal Brogan)

- **Enact a science-driven upgrade plan for ALMA:**

ALMA2030 -> ALMA Future Vision

- **Integrated plan for development built into budget!**
- **Studies (10%, 1 year)**
- **Projects (remainder, 2-3 years)**

Equipping ALMA For the Next Decade and Beyond

(Crystal Brogan)

My personal view, from the outside:

**Projects and even Studies often
produce tangible value for the
community and for science.**

GBT at High Frequencies (20-115 GHz)

(Alberto Bolatto)

Array receivers, collecting area, and routine high-frequency operations make GBT *uniquely* well-suited for large-scale, sensitive, multi-line/ broad bandwidth science.

The GBT is highly *complementary* to interferometers.

“Multiplying steel”



The Large Millimeter Telescope

(Peter Schloerb)

- “Single dish complement to ALMA”
- 32 m now, upgrading to 50 m in 1 yr
- 0.85 - 4 mm
- 4' FoV
(CCAT' 7 deg)
(CSST 1 deg)

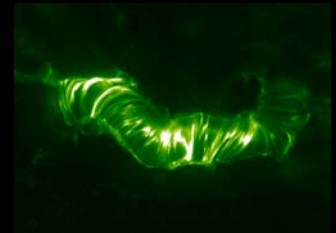
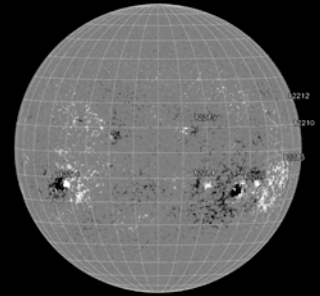
The Large Millimeter Telescope

(Peter Schloerb)

- **10x 100-hr public ToI TEC surveys at 2.1, 1.4, 1.1 mm (7000 pixels, polarimetry)**
- **Seeking partners/US access**
- **Plans to fill FoV for spectroscopy**

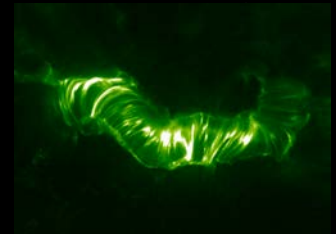
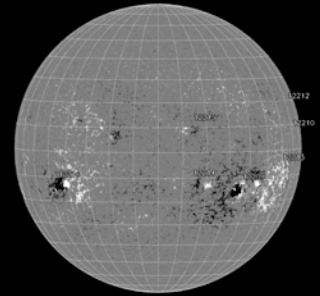
Next Generation Radioheliograph (Tim Bastian)

- **Successor to FASR: time to update!**
- **Ultra-broadband solar imaging and spectroscopy: image entire solar atmosphere in 3D every second.**
- **Complementarity with DKIST, Solar Probe Plus, Solar Orbiter (and ALMA, JVLA, ...)**
- **Serves multiple constituencies**
 - **National Space Weather Strategy: CMEs**
 - **Solar, space, and plasma physics**



Next Generation Radioheliograph (Tim Bastian)

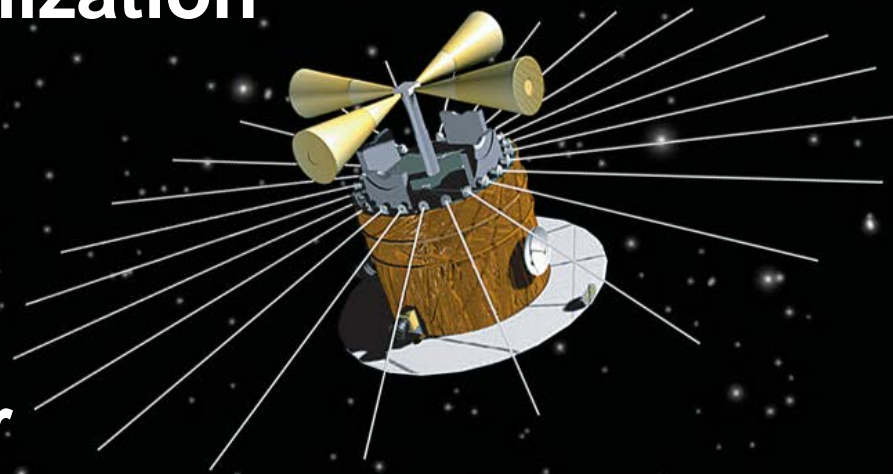
- Frequency, time, polarization, FoV, resolution
- 50 MHz - 21 GHz
- FASR would be ~\$80M + \$3.5M/yr in ops in 2016 dollars
- “Modest” risk in previous reviews



Dark Ages Radio Explorer

(Rich Bradley)

- Detect and measure the global 21 cm signal from the Epoch of Reionization
- Use the Moon as shield from Earth, Sun
- NASA midscale explorer
- 40-120 MHz ($z = 11-35$)
- Explore/characterize the first objects at $z > 10$ and their impact on reionization



Dark Ages Radio Explorer

(Rich Bradley)

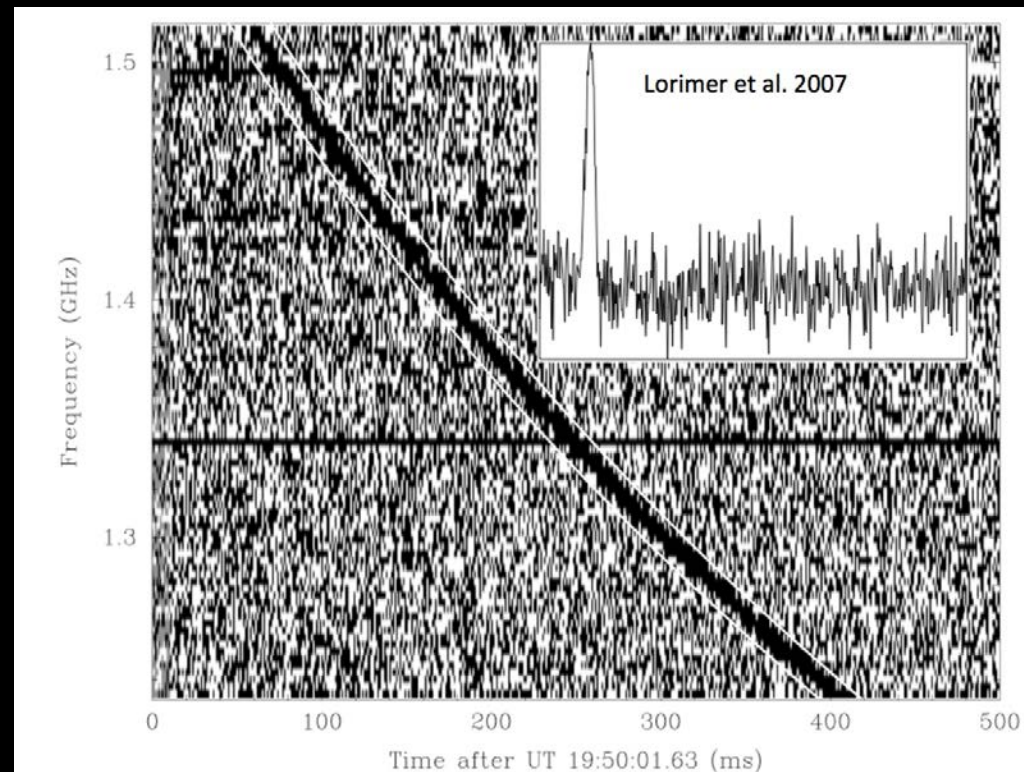
- **Significant systematics**
- **Significant foregrounds**
- **Sky measurement of less than 50 mK required**



Scalable cm-Wavelength Aperture Arrays

(Steve Ellingson)

- FRBs: what are they?
- ~4400 in the sky per day!
- Need detection, localization, characterization



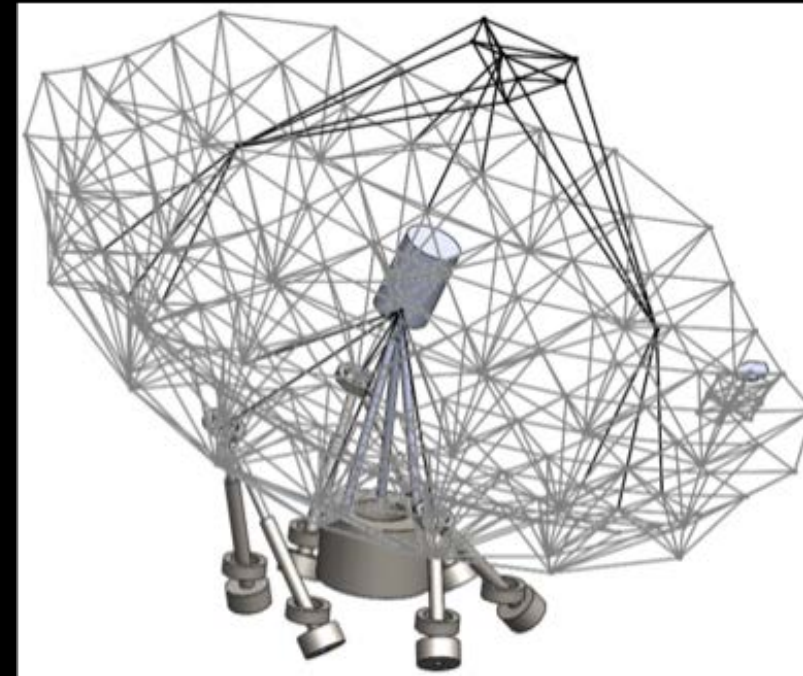
Scalable cm-Wavelength Aperture Arrays

(Steve Ellingson)

- **Large Array of Small Arrays in L-band**
- **Multiple beams**
- **For 32 tiles, 16 beams, \$3M**
- **Equivalent to 9 m telescope (but with 16 beams)**

Chajnantor Sub/millimeter Survey Telescope (Sunil Golwala)

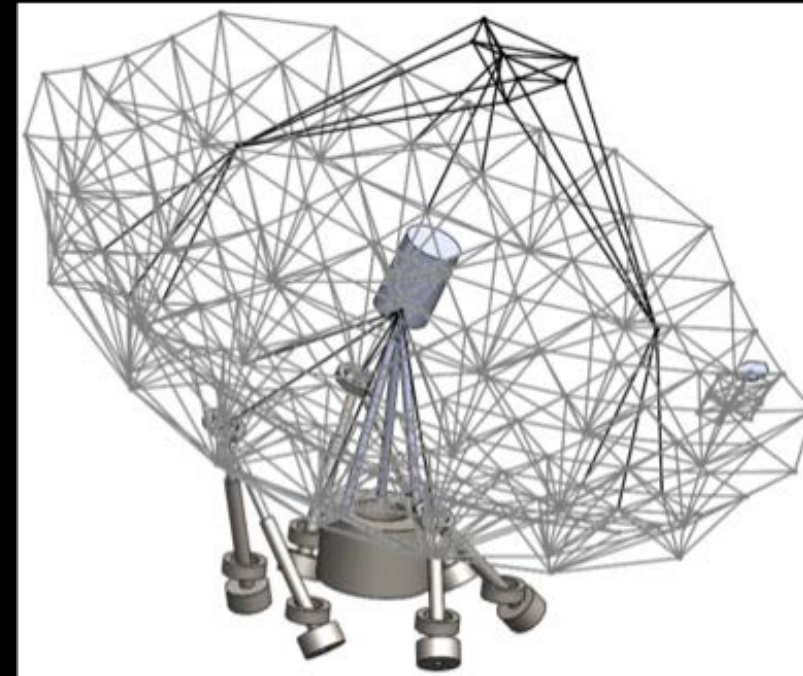
- 30 m survey telescope
- 850 micron “prime science” band
- [CII] workhorse line, $z > 3.5$
- Limited sky access (but in the tropics)
- 1 degree FoV



Chajnantor Sub/millimeter Survey Telescope

(Sunil Golwala)

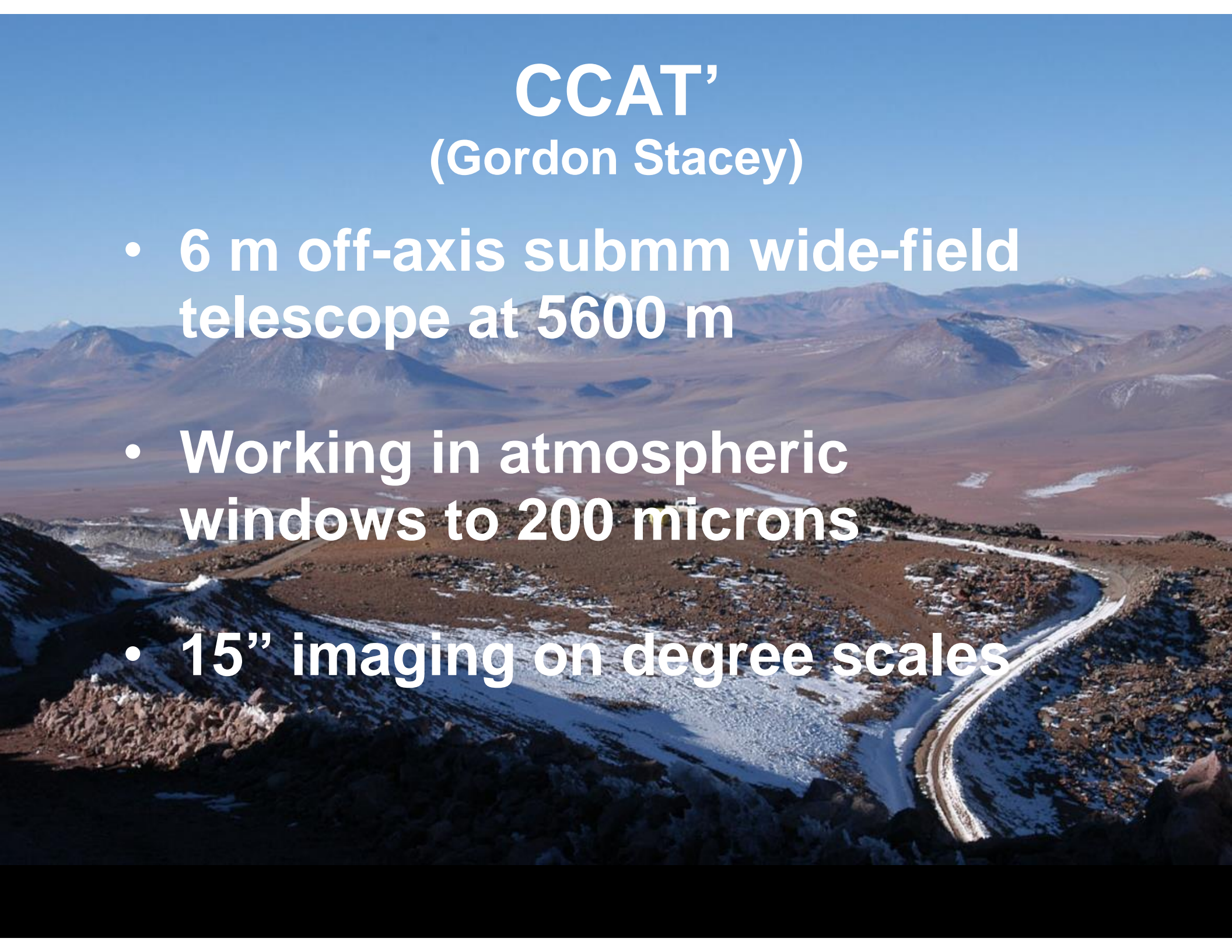
- **Evolution of dusty star-forming galaxies**
- **Drivers and impacts of SF in 1000s of galaxies**
- **Star formation in Galaxy and nearby galaxies**
- **Galaxy cluster studies and SZ cosmology**
- **Discovery!**



CCAT'

(Gordon Stacey)

- 6 m off-axis submm wide-field telescope at 5600 m
- Working in atmospheric windows to 200 microns
- 15" imaging on degree scales



CCAT'

(Gordon Stacey)

- [CII] intensity mapping in EoR ($z = 5-9$)
- Kinetic S-Z effect
- Star formation in MW and nearby galaxies in FS atomic lines, high-J CO
- CMB studies (Stage 4)

Comparisons

- **CSST, CCAT', LMT complementary**
- **BUT some redundancies/themes:**
 - **Galactic SF**
 - **High-redshift SF**
 - **S-Z studies**

Discussion

